

REMARKS

Applicant respectfully requests further examination and reconsideration in view of the arguments set forth fully below. In the Office Action mailed March 15, 2006, claims 1-72 have been rejected. In response, the applicant has submitted the following remarks. Accordingly, claims 1-72 are still pending. Favorable reconsideration is respectfully requested in view of the remarks below.

Rejections Under 35 U.S.C. § 102

Claims 1-4, 15-18, 29, 33, 44-48 and 59 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,564,429 to Bornn et al. (hereinafter Bornn). The applicant respectfully disagrees with this rejection.

The Bornn reference teaches a method of identifying valid signal carrying channels in a cardiorespiratory alert system. Bornn defines the term “reference” to not teach using an electrode on the patient’s back as the reference input to an amplifiers negative input. In other words, Bornn has used the term “reference” in a different manner than in the present invention. In Bornn, the ECG signals are exclusively bipolar, wherein every amplifier described by Bornn takes the difference between the voltage at exactly 2 electrodes, which are referred to as “electrode pairs” (Bornn, column 9, lines 57-67).

The instrumentation amplifier 1012 of Fig. 12A in Bornn clarifies that each amplifier has a plus and negative input, as with amplifier 1068, which trace back to 2 electrodes, the electrode pair. The “common” signal is clearly identified in Fig. 12A as not connecting to either the plus or minus inputs of the amplifier. Furthermore, Bornn’s use of the term “reference” is made synonymous with the term “common” (Bornn, column 10, line 4 and column 20, line 57).

Furthermore, the reference in Bornn in column 20, lines 51-59 and Fig. 12 make clear that Bornn’s “reference” is never a plus or minus input to the difference amplifier. Fig. 3 shows that Bornn’s “common” electrodes do not connect to the amplifier plus or minus inputs. Table 1 of column 25 of Bornn makes clear that all ECG pairs, which will be inputs of the amplifiers, are only on the patient’s front side. Even though the table is

incomplete, the caption shows that there is no nomenclature to use the electrodes for the patient's back as members of electrode pairs.

Referring to column 10, lines 4-6 of Bornn make clear that the back electrodes are tended for the "common" (or "reference") function. Lines 6-9 make clear that multiple such electrodes are desirable. Although it is clear that there are a plurality of electrodes on the back, Bornn teaches no reason to use them for anything other than the "common" or so-called "reference" function. It should also be noted that where the Office Action makes a citation that an electric signal is acquired from at least one of the plurality of electrodes that is attachable to a patient's back in column 9, lines 57-67, that this citation refers to the tension sensors, item 26, which are not ECG electrodes, but are tension sensors that detect breathing motions.

In contrast to the teachings of Bornn, the method and apparatus for generating electrocardiogram precordial leads using a precordial central terminal of the present invention includes the two terms "common" and "reference", having very different meanings. Usually the terms "ground" and "common" are synonymous, and the term "reference" has an important meaning, as is described in the present invention. The important difference occurs as the present invention expands beyond polar expands, beyond bipolar ECG leads, and unipolar ECG leads are created. In such a case, a reference signal is needed to feed into the minus (negative) input of the ECG difference amplifier. A third line may be ground or common. But, importantly, the reference needed for the unipolar lead must be some combination of multiple leads. As was discussed in a previous Examiner Interview, the classic reference is the Wilson central terminal. The Wilson central terminal is an average of three limb electrodes and clearly uses the term "reference" for attaching to the inverting (minus) input of the amplifier. The advantage of the combination multiple electrodes into the reference (minus) input is that the voltage at any one of the reference electrodes is diluted. The bipolar ECG lead uses 2 electrodes. The minus electrode has as much weight as the plus electrode. Ironically, the unipolar ECG leads use not one but 4 electrodes. What is gained is that the amplifier output signal is highly dependent on the voltage at 1 (the plus) electrode,

whereas the voltages at all the other 3 reference electrodes are averaged together and therefore of lesser significance individually. Therefore the "reference" that is taught in Bornn is not "reference" that is taught in the present invention. The Bornn reference, once again, does not teach using electrodes on the patient's back, either singly or in combination, as any part of the difference inputs of the ECG amplifiers.

The independent claim 1 is directed to a device for acquiring and processing electrical signals produced by a patient's heart comprising a plurality of electrodes configured on an electronic belt for attachment to the patient's upper torso, wherein the plurality of electrodes does not include electrodes for attachments to the patient's limbs, and further wherein at least one of the plurality of electrodes is attachable to the patient's back, an acquisition module coupled to the plurality of electrodes for acquiring electrical signals from the plurality of electrodes and a signal processor coupled to the acquisition module for generating a plurality of electrocardiogram precordial leads from the acquired signals. As described above, Bornn does not teach a device for acquiring and processing signals including at least one of a plurality of electrodes being attachable to a patient's back, and a signal processor generating a reference signal from an electric signal acquired from the electrode that is attached to the patient's back. For at least these reasons, the independent claim 1 is allowable over the teachings of Bornn.

Claims 2-4 and 15 are all dependent upon the independent claim 1. As discussed above, the independent claim 1 is allowable over the teachings of Bornn. Accordingly, claims 2-4 and 15 are also allowable as being dependent upon an allowable base claim.

The independent claim 16 is directed to an electrocardiogram device for acquiring and processing electrical signals produced by a patient's heart comprising a belt adapted to be attached to the patient's upper torso, a plurality of electrodes coupled to the belt, wherein the plurality of electrodes does not include electrodes for attachment to the patient's limbs and further wherein at least one of the plurality of electrodes is attachable to the patient's back, an acquisition module coupled to the belt and the plurality of electrodes for acquiring electrical signals from the plurality of electrodes, a signal processor coupled to the acquisition module for generating a plurality of

electrocardiogram precordial leads from the acquired electrical signals wherein the signal processor generates a reference signal from an electric signal acquired from the at least one of the plurality of electrodes that is attachable to the patient's back, a transmitter coupled to the acquisition module for transmitting the plurality of electrocardiogram precordial leads and a receiver wirelessly coupled to the transmitter for receiving the acquired electrical signals. As described above, Bornn does not teach a device for acquiring and processing signals including one of a plurality of electrodes being attachable to a patient's back, and wherein a signal processor generates a reference signal from an electrical signal acquired from the at least one of the plurality of electrodes that is attachable to the patient's back. For at least these reasons, the independent claim 16 is allowable over the teachings of Bornn.

Claims 17-18 and 29 are all dependent upon independent claim 16. As discussed above, independent claim 16 is allowable over the teachings of Bornn. Accordingly, claims 17-18 and 29 are also allowable being dependent upon an allowable base claim.

The independent claim 30 is directed to an acquisition device for attachment to a patient and for acquiring electrical signals produced by the patient's heart comprising a belt adapted to be attached to the patient's upper torso, a plurality of electrodes coupled to the belt, the plurality of electrodes including at least one electrode position within the belt so that when the belt is attached to the patient, the electrode contacts that patient's chest, and at least one electrode positioned within the belt so that when the belt is attached to the patient the electrode contacts the patient's back, wherein the plurality of electrodes does not include electrodes for attachment to the patient's limbs, an acquisition module including a signal processor coupled to the belt and the plurality of electrodes for acquiring electrical signals from the plurality of electrodes, wherein the signal processor generates a reference signal from an electric signal acquired from the at least one electrode that contacts the patient's back, and for generating a plurality of electrocardiogram precordial leads from the acquired signals and a transmitter coupled to the acquisition module for transmitting the plurality of the electrocardiogram precordial leads to a remote location. As described above, Bornn does not teach the feature of a

device for acquiring and processing signals including one of a plurality of electrodes being attachable to a patient's back, and wherein a signal processor generates a reference signal from an electrical signal acquired from the at least one electrode that contacts the patient's back. For at least these reasons, the independent claim 30 is allowable over the teachings of Bornn.

Claims 31-33 and 44 are all dependent upon the independent claim 30. As discussed above, the independent claim 30 is allowable over the teachings of Bornn. Accordingly, claims 31-33 and 44 are all allowable as being dependent upon an allowable base claim.

The independent claim 45 is directed to a method of acquiring and processing electrical signals produced by a patient's heart comprising positioning a plurality of electrodes on the patient's upper torso, without positioning electrodes on the patient's limbs, positioning at least one of the plurality of electrodes on the patient's back, acquiring electrical signals from a plurality of electrodes with an acquisition device, processing the electrical signal acquired from the at least one of the plurality of electrodes on the patient's back as a reference signal and generating a plurality of electrocardiogram precordial leads from the acquired electrical signals. As described above, Bornn does not teach a device for acquiring and processing signals including one of a plurality of electrodes being attachable to the patient's back, and processing an electric signal acquired from the at least one of a plurality of electrodes on the patient's back as a reference signal. For at least these reasons, the independent claim 45 is allowable over teachings of Bornn.

Claims 46-48 and 59 are all dependent upon the independent claim 45. As discussed above, the independent claim 45 is allowable over the teachings of Bornn. Accordingly, claims 46-48 and 59 are also allowable as dependent upon an allowable base claim.

Rejections Under 35 U.S.C. §103

Claims 5-6, 19-20, 34-35 and 49-50 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Bornn as applied to claims 1, 16, 30 and 45 above, and in view of U.S. Patent No. 5,511,533 to Segalowitz (hereinafter Segalowitz). The Applicant respectfully disagrees with this rejection.

Claims 5-6, 19-20, 34-35 and 49-50 are dependent upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn. Accordingly, claims 5-6, 19-20, 34-35 and 49-50 are all allowable as being dependent upon an allowable base claim.

Claim 7, 14, 21, 28, 36, 43, 51 and 58 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn and Segalowitz as applied to claims 1, 5, 16, 19, 30, 34, 45 and 49 above and further in view of Shusterman. Claims 7, 14, 21, 28, 36, 43, 51 and 58 are dependent upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn. Accordingly, claims 7, 14, 21, 28, 36, 43, 51 and 58 are all allowable as being dependent upon an allowable base claim.

Claims 8, 11-12, 22, 25-26, 37, 40-41, 52, 55 and 56 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn and Segalowitz as applied to claims 1, 16, 30 and 45 above, and further in view of GE Medical Systems Information Technologies, ACI-TIPT Standard 12/15-Lead Placement. Claims 8, 11-12, 22, 25-26, 37, 40-41, 52, 55 and 56 depend upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn. Accordingly, claims 8, 11-12, 22, 25-26, 37, 40-41, 52, 55 and 56 are also allowable as being dependant upon an allowable base claim.

Claims 9, 23, 38 and 53 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn, Segalowitz and GE Medical Systems Information Technologies as applied to claims 8, 22, 37 and 52 and further in view of Shusterman. Claims 9, 23, 38 and 53 are dependent upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn.

Accordingly, claims 9, 23, 38 and 53 are allowable as being dependent upon an allowable base claim.

Claims 10, 24, 39 and 54 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn, Segalowitz, GE Medical Systems Information Technologies and Shusterman as applied to claims 9, 23, 38 and 53 above, and further in view of U.S. Patent No. 5,615,687 to Pritchard (hereinafter Pritchard). Claims 10, 24, 39 and 54 are dependent upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn. Accordingly, claims 10, 24, 39 and 54 are allowable as being dependent upon an allowable base claim.

Claims 13, 27, 42 and 57 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn, Segalowitz, and GE Medical Systems Information Technologies as applied to claims 12, 26, 41 and 56, and further in view of Pritchard. Claims 13, 27, 42 and 57 are dependant upon the independent claims 1, 16, 30 and 45. As discussed above, the independent claims 1, 16, 30 and 45 are allowable over the teachings of Bornn. Accordingly, claims 13, 27, 42 and 57 are allowable as dependant upon an allowable base claim.

Within the Office Action, claims 60-64 and 71-72 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bornn in view of Segalowitz and Shusterman. The independent claim 60 is directed to a method of acquiring and processing electrical signals produced by a patient's heart comprising positioning a plurality of electrodes on the patient's upper torso, the plurality of electrodes including at least one electrode positionable on the patient's chest and at least one electrode positionable on the patient's back, wherein the plurality of electrodes does not include electrodes for positioning on the patient's limbs, acquiring electrical signals from the plurality of electrodes with an acquisition module, processing the electrical signal acquired from the at least one electrode positioned on the patient's back as a reference signal, generating an approximation of an electrical potential near the center of the patient's heart by determining a weighted combination of a plurality of the acquired electric signals and

generating a plurality of electrocardiogram precordial leads from the acquired electrical signals by subtracting the approximation of the electrical potential near the center of the patient's heart from each one of the signals acquired from the at least one electrode on the patient's chest. For the same reasons, as described above in the discussion of claims 1, 16, 30 and 45, the independent claim 60 is allowable over the teachings of Bornn, Segalowitz, Shusterman and their combination.

Claims 61-64 and 71-72 are dependent upon the independent claim 60. As discussed above, the independent claim 60 is allowable over the teachings of Bornn, Segalowitz, Shusterman and their combination. Accordingly, claims 61-64 and 71-72 are also allowable as being dependent upon an allowable base claim.

Claims 65-66 and 68-69 have been rejected under 35 §103(a) as being unpatentable over Bornn, Segalowitz, and Shusterman as applied to claim 60 above, and further in view of GE Medical Systems Information Technologies. Claims 65-66 and 68-69 are dependent upon the independent claim 60. As discussed above, the independent claim 60 is allowable over the teachings of Bornn, Segalowitz, Shusterman, and their combination. Accordingly, claims 65-66 and 68-69 are allowable as being dependent upon the allowable base.

Claim 67 has been rejected under 35 USC §103(a) as being unpatentable over Bornn, Segalowitz, Shusterman and GE Medical Systems Information Technologies as applied to claim 66 above, and further in view of Pritchard. Claim 67 is dependent upon the independent claim 60. As discussed above, the independent claim 60 is allowable over the teachings of Bornn, Segalowitz, Shusterman, and their combination. Accordingly, claim 67 is also allowable as being dependent upon an allowable base claim.

Claim 70 has been rejected under 35 USC §103(a) as being unpatentable over Bornn, Segalowitz, and Shusterman, as applied to claim 69 above and further in view of Pritchard. Claim 70 is dependent upon the independent claim 60. As discussed above, the independent claim 60 is allowable over the teachings of Bornn, Segalowitz,

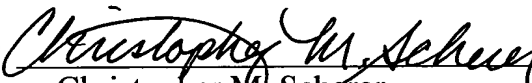
Application No. 09/682,421
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Reply to Office Action of March 15, 2006

Shusterman, and their combination. Accordingly, claim 70 is also allowable as being dependent an allowable base claim.

For these reasons, Applicants respectfully submit that all of the claims are now in a condition for allowance, and allowance at an early date would be appreciated. Should the Examiner have any questions or comments, they are encouraged to call the undersigned at 414-271-7590 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,

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